Determinants of primary education quality: what can we learn from PASEC for francophone Sub-Saharan Africa?

Michaelowa, Katharina

Abstract: Since the early 1990s, the "Programme of Analysis of Education Systems" (PASEC) has regularly collected data of student achievement in French and math for primary school students in francophone sub-Saharan Africa. This paper synthesises some of the most important results from studies based on the PASEC data set. With respect to teachers' competencies, the available evidence reveals that it is not sufficient - and may even be counterproductive - to simply enhance the required duration of teacher training. Well-designed non-civil-servant contract-teacher programmes may be successfully introduced without compromising on education quality, even though they show some negative impact on teacher job satisfaction. PASEC data also indicate that despite the high average class size in francophone African countries, the negative impact of student numbers is not as strong and not as consistent as one might expect. Among instructional materials and physical infrastructure, textbooks in the basic language of instruction appear to have the most important positive influence on education quality. Finally, PASEC provides strong and unambiguous evidence against the efficiency of grade repetition. Depuis 1990, le Programme d'analyse des systèmes éducatifs (PASEC) collecte régulièrement des données sur les performances, en français et en mathématiques, des élèves d'écoles primaires de pays d'Afrique subsaharienne francophone. Ce document résume certains des résultats les plus importants tirés des études réalisées à partir des données du PASEC. Concernant les compétences des enseignants, les éléments disponibles indiquent qu'il n'est pas suffisant de renforcer la durée de la formation pédagogique - cette mesure peut même être contre-productive - et qu'il est possible de recourir à des formules contractuelles bien conçues, qui ne sont pas des contrats de fonctionnaires, sans pour autant compromettre la qualité de l'éducation. Ce système a cependant un impact négatif sur la gratification professionnelle des enseignants. En Afrique francophone, le nombre d'élèves par classe est souvent très élevé. Les données PASEC montrent cependant que l'impact négatif de ce facteur est moins important qu'il n'y paraisse. S'agissant du matériel éducatif et des infrastructures physiques, la disponibilité de livres de classe, rédigés dans la langue pratiquée couramment par l'élève, semble être le facteur qui exerce une influence positive la plus grande sur la qualité de l'éducation. Enfin, les données PASEC montrent, sans ambiguïté, que les redoublements ne sont pas efficaces.

Other titles: Les déterminants de la qualité de l'éducation primaire: enseignements de la mise en œuvre du PASEC en Afrique subsaharienne francophone

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Background paper

Determinants of Primary Education Quality: What can we learn from PASEC for francophone Sub-Saharan Africa?

by

Katharina MICHAELOWA

Working Document
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Association for the Development of Education in Africa (ADEA)
International Institute for Educational Planning
7-9 rue Eugène Delacroix
75116 Paris, France
Tel.: +33(0) 1 45 03 77 57
Fax: +33(0)1 45 03 39 65
adea@iiep.unesco.org
Web site: www.ADEAnet.org

Abstract

Since the early 1990s, the "Programme of Analysis of Education Systems" (PASEC) has regularly collected data of student achievement in French and math for primary school students in francophone sub-Saharan Africa. This paper synthesises some of the most important results from studies based on the PASEC data set. With respect to teachers' competencies, the available evidence reveals that it is not sufficient - and may even be counterproductive - to simply enhance the required duration of teacher training. Well-designed non-civil-servant contract-teacher programmes may be successfully introduced without compromising on education quality, even though they show some negative impact on teacher job satisfaction. PASEC data also indicate that despite the high average class size in francophone African countries, the negative impact of student numbers is not as strong and not as consistent as one might expect. Among instructional materials and physical infrastructure, textbooks in the basic language of instruction appear to have the most important positive influence on education quality. Finally, PASEC provides strong and unambiguous evidence against the efficiency of grade repetition.

Determinants of Primary Education Quality: What can we learn from PASEC for francophone sub-Saharan Africa?

Background paper for the ADEA study on Education Quality
by Katharina Michaelowa
Hamburg Institute of International Economics (HWWA)[1]

1. Introduction

Since the early 1990s, the "Programme of Analysis of Education Systems" (PASEC[2]) managed under the authority of the conference of francophone education ministers (CONFEMEN[3]) has regularly collected data of student achievement in French and math for primary school students in francophone sub-Saharan Africa. An outline of the program's scope and development as well as a cross-country comparison of student performance derived from the program is provided by another background paper to the ADEA study (CONFEMEN 2003a).

Similar to its sister programs SACMEQ[4] and MLA[5], PASEC allows us to link educational achievement to students' socio-economic background and factors related to teachers and schools. Under the assumption that student achievement in the two central subjects of math and French is accepted as a viable indicator of education quality, the available data therefore provide the opportunity to empirically test the impact of various measures of educational policy, and to establish priorities among these measures based on a joint analysis of cost and benefits.

With this objective in mind, the CONFEMEN has regularly produced national reports based on the different country evaluations, and other independent studies have followed. The intention of this paper is to synthesise the results of these studies, at least since 1995 where PASEC evaluations became fully comparable across countries. We will start with a list of factors generally perceived as crucial determinants of education quality and then discuss to which extent this perception is confirmed by the available empirical evidence. While student achievement in most PASEC countries also depends to a large extent on individual, rather than on school related factors (see CONFEMEN 2003a, p.10), the latter are more easily amenable to educational policy. The focus of this paper therefore lies on schools and teachers. Nevertheless, it should be kept in mind that given the importance of the individual students' family background, a general improvement of the socio-economic situation, of the children's health and nutrition and / or of parents' educational status, can also be expected to considerably improve the chances of child learning.

It should also be noted that despite the richness of the PASEC data set, not all questions relevant in the context of education quality could be addressed. Since tests are carried out in French in order to be comparable across countries, there is no information on the usefulness of alphabetisation in students' mother tongues. Moreover, information is lacking on instruction time and the adequacy of curricula. Finally, even though there is a lot of information about teachers, some of the supposedly most relevant determinants of teacher motivation cannot be directly derived from the data. In particular, there is no direct

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[1] Author's contact: k-michaelowa@hwwa.de.
[2] The official French name of PASEC is: "Programme d'analyse des systèmes éducatifs de la CONFEMEN".
[3] "Conférence des ministres de l'éducation des pays ayant le français en partage".
[4] "Southern African Consortium for Monitoring Educational Quality", for details see Ross (1998).
[5] "Monitoring Learning Achievement", for details see Chinapah (1997).

information on individual teachers' salaries, and information on factors of intrinsic motivation are relatively scarce.

With these limitations in mind, we can now begin the discussion of concrete educational policy measures. Section 2 will start with the issue of teachers, their competencies and motivation as a crucial factor of educational achievement. Section 3 will report the evidence on class size and related variables of class management. Section 4 will discuss PASEC results on instructional material and physical infrastructure. Section 5, finally, will provide a discussion of a particularity of education in francophone Africa: the high repetition rates. Section 6 concludes.

2. Teacher competencies and motivation

The role of teachers is crucial for the transfer of knowledge in schools. At the same time, teachers' remuneration is the biggest cost factor in educational finance. In most countries, developing and industrialised alike, teacher salaries account for between half and three fourth of current education expenditure. In some African countries, their part rises up to 90% (World Bank 2002). Given the magnitude of the financial investment involved, it is extremely important to know whether these fund are used efficiently.

Let us start with the aspect of teacher motivation.

2.1 Teacher motivation

Many African sources paint a rather desperate picture of a generally demoralised teaching profession (for an overview, see Maclure 1997, Chapter 4). PASEC provides several indicators that can be used to gain an overall impression of the situation. The most direct indicator of teacher job satisfaction indicates whether teachers would choose the same profession again if they had to renew their choice. In addition, data indicate whether they would like to move away from the institution where they are currently employed. And finally, teachers report about their absence from work, an auxiliary indicator often considered to be negatively correlated with job satisfaction. Based on these three indicators, Table 1 provides an overall impression of teacher job satisfaction for 5th grade teachers in five PASEC countries.

Table 1: Indicators of teacher job satisfaction, 1995-1998

	Burkina Faso	Cameroon	Côte d'Ivoire	Madagascar	Senegal	Total
Share of teachers who would choose the same profession again, in %	56.7 (4.9)	55.8 (5.1)	45.8 (4.6)	65.5 (4.4)	40.6 (5.0)	53.2 (4.8)
Share of teachers who would like to change schools, in %	43.3 (4.9)	38.9 (5.0)	54.2 (4.6)	23.5 (3.9)	61.5 (5.0)	43.8 (4.7)
Teachers' average absence, in working days/month	2.24 (0.38)	1.80 (0.39)	1.28 (0.16)	2.50 (0.42)	4.72 (0.54)	2.39 (0.38)

Annotation: Standard errors in parenthesis.
Source: Michaelowa (2002).

Overall, more than 50% of 5th grade teachers seem to prefer teaching to any other profession, and almost 60% like their schools and do not want to change. At the same time, as almost half of the teachers would prefer another job, and more than 40% would like to change schools, there is definitely much room for improvement.

Moreover, absenteeism appears to be a serious problem. PASEC data indicate that teachers, on average, miss their classes during half a week per month. Assuming that teachers rather understate than overstate their absence, and that they tend to deny reporting when their absenteeism is particularly pronounced, the true situation can be supposed to be even worse.

However, Table 1 also shows that there are significant differences between individual countries. The situation is clearly the worst in Senegal where the average teacher is absent about twice as much as in all other countries. The other indicators point into the same direction: More than 60% of teachers would like to change schools if they had the occasion, and only slightly above 40% would choose the teaching profession again. In both cases, the figure indicates a lower job satisfaction than in any other country, and significantly differs from the country average.

Côte d'Ivoire also shows a relatively low level of job satisfaction. While the share of teachers who would again choose the teaching profession is considerably higher, and the share of teachers willing to change schools considerably lower than in Senegal, these differences are not significant at a level of 5%. Only with respect to its comparatively low absence rates, Côte d'Ivoire shows a significantly better result than Senegal.

At the other end of the scale, there is Madagascar, with about average absence rates but an exceptionally strong preference for both teachers' current profession and institution. Over 65% would choose the same profession again, and only 23.5% would like to change schools. Burkina Faso and Cameroon find their positions in between.

As can be expected, low rates of job satisfaction as measured by any of the above indicators can be shown to be detrimental to student learning (Bernard 1999a, p. 23; Michaelowa 2002, p. 21; Michaelowa 2000, p. 27; Amelewonou and Nkengne Nkegne 2003, p. 54). This implies that education quality can be influenced by influencing teacher job satisfaction.

However, more surprisingly, regression analysis shows that many policy variables have a simultaneous direct impact on both teacher job satisfaction and student achievement, and that this impact is not always complementary, but often conflicting. This conflict between the objectives of rising educational quality and improving teachers' job satisfaction is particularly obvious with respect to the impact of inspections and non civil service teaching contracts.

The regular visits of inspectors are a special feature of francophone education systems across the world. While the relevance of these visits appears to be less obvious at the early stages of education, they show a strongly significant and robustly positive impact on student achievement at 5^{th} grade (Bernard 1999a, p. 26; Michaelowa 2000, p. 27; 2001a, p. 1706 and 2002, p. 21).

They also appear to significantly reduce teachers' absenteeism. However, in this case, reduced absenteeism appears to be a reaction to control, rather than a sign of higher of satisfaction. Both the other indicators of job satisfaction point into the opposite direction. In particular, teachers at schools with inspections show a significantly greater preference to move away from their institution than teachers in schools without regular inspections.

The situation is similar with respect to contractual arrangements which engage teachers at schools without granting them the traditional position in the civil service. The so called "contract teachers" therefore enjoy much less job security, and, in addition, they often receive

considerably lower salaries. Understandably, this appears to reduce their satisfaction with their current position inducing them to search for other positions elsewhere. At the same time, the incentive structure created by these contracts significantly reduces absenteeism and enhances (rather than reduces) student achievement in their classes (Michaelowa 2002, p. 11).

It should be noted, however, that the above quoted results are based only on five particular country-cases, and based on data from a time period where this type of contractual arrangement was still rather exceptional. In between, the number of contract teachers has risen significantly, employment programmes for contract teachers have been launched in many countries of the region, and the concrete features of these programmes vary considerably. PASEC will therefore proceed with three country-case studies of which the first (for Guinea) is almost completed. So far, the results of the Guinea study seem to broadly confirm the above analysis (CONFEMEN 2003b). We shall come back to this concrete example in the next subsection.

There are only a few variables whose impact is unambiguously positive regarding both the objective of teacher job satisfaction and the objective of student achievement. The most important one is related to classroom equipment. Not surprisingly, teachers prefer to teach in schools well equipped with electricity and instructional material, in particular textbooks. Moreover, they dislike teaching classes with high student numbers and classes organised in double shifts – with two different groups of students of the same level being taught at different times of the day (Michaelowa 2002, p. 11). This should be kept in mind for later sections of this paper where the direct impact of these factors on student achievement will be discussed in more detail.

Several variables were introduced into the empirical analysis in order to test the influence of other, more intrinsic factors on teacher job satisfaction. Among these were the communication among teachers and the integration into the local community. Unfortunately, despite strong theoretical support for such a relationship, no statistically significant correlation could be discerned. This aspect possibly requires more in depth research trying out various indicators and non linear model specifications.

2.2 Teacher competencies

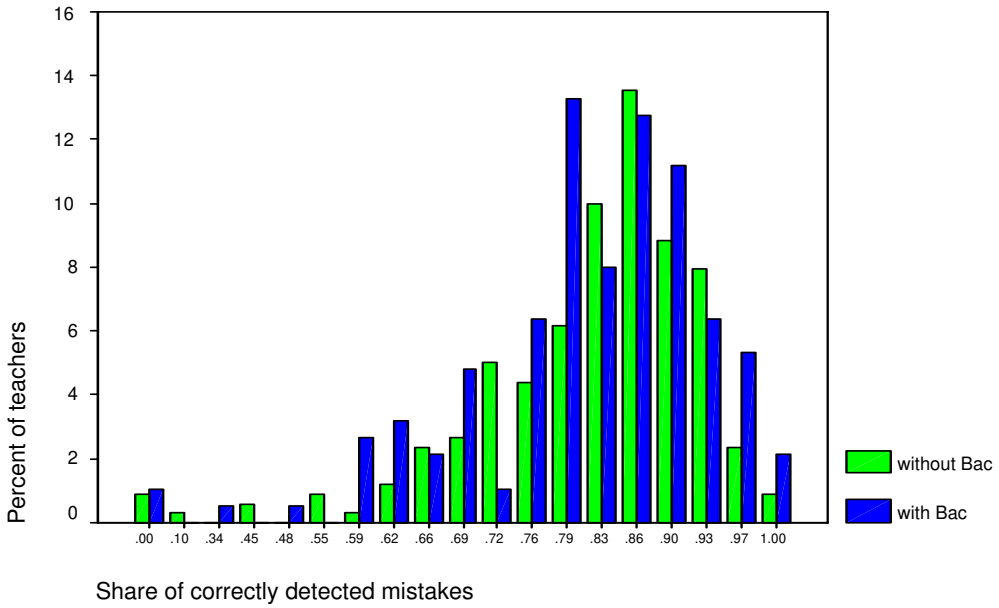
A second and potentially related aspect is the question of teacher competencies. It is obvious that successful teaching requires the knowledge of both the subject matter and the pedagogical tools to transfer this knowledge to students. Competencies are typically measured only indirectly via years of schooling, the time spent on training, or diplomas obtained. An overview of teachers' formal educational attainment in PASEC countries is provided by Bernard (1999b, pp. 10ff.)

Unfortunately, as the quality and the relevance of training programmes may sometimes be questionable, and, in any case, vary widely across training centres, regions etc., using this kind of indicator as a proxy for teacher competencies makes it difficult to measure any sizeable impact on student performance. While some PASEC studies do obtain a significant and positive effect of teachers' educational attainment (Michaelowa 2001a, p. 1707) or continuation training (Michaelowa 2000, p. 28), a more detailed look into different countries, different grades, and different types of studies leads to a variety of seemingly inconsistent and hardly understandable results.

For instance, in some country-cases, it has been observed that short-term as well as long-term training appeared to have a positive effect while the opposite seemed to be true for a training of intermediate duration (see e.g. the case of Cameroon, CONFEMEN 1999a, p. 139). In other cases, only the intermediate duration appeared to be efficient (see e.g. the case of Côte d'Ivoire, CONFEMEN 1999a, p. 140). This simply confirms that the mere duration of teacher education and training is an extremely bad indicator of teacher competencies. In the examples quoted above, the different duration may reflect different training programmes of different relevance and quality.

While mainly based on these indirect indicators, PASEC also provides one simple direct measure of teachers' competencies. This is the share of correctly detected errors when correcting a fictitious student's dictation. There have been some inconsistencies in the codation of this variable and the indicator is not available for all PASEC countries, but nevertheless, Bernard (1999a, p. 70) finds a significant positive impact on student performance. It is interesting to note, that, when analysed for 5th grade teachers in Burkina Faso, Cameroon, Côte d'Ivoire and Senegal, no significant correlation can be discerned between the results of this exercise and the teachers' level of educational attainment. Figure 1 shows that among teachers with an educational attainment above the "baccalauréat" (Bac), the share of those correctly detecting all (or almost all) mistakes is slightly higher. At the same time, they are also more frequent to do very badly. On average, there is virtually no difference between the two groups.

Figure 1: Teacher performance at correcting a dictation, by level of educational attainment



While somewhat disillusioning, these results imply a strong message for educational policy making: If the objective is to enhance teacher competencies, this is not a question of simply increasing the entry requirements into the teaching profession from levels below the Bac to the Bac or beyond. Similarly, simply rising pedagogical training requirements from short-term to long-term training does not seem to be promising. Increasing requirements in terms of duration will simply increase the cost of training and employment without improving education quality. What is needed is an investment in the quality rather than the duration of teacher training.

In fact, simply raising requirements in terms of duration can even have detrimental effects on education quality. This refers us back to the discussion of teacher motivation. It seems that as long as academic education and pedagogical training do not prepare teachers sufficiently well for their later job, the longer they study, the stronger will be the mismatch between their expectations and the reality they will have to face. Correspondingly, PASEC data provide a strong evidence that teachers with an educational attainment of at least the Bac are often particularly dissatisfied with their professional choice (Michaelowa 2002, p. 12).

Generally speaking, there certainly is a positive link between teacher competencies and job satisfaction as the literature would suggest (see e.g. Hackman and Oldham 1980, Ma 1999). However, if teacher education does not build up these competencies, but rather raises unrealistic expectations, the overall effect will be negative rather than positive.

Let us now come back to the recent PASEC evaluation of the Guinean education system, and, more precisely, of the FIMG-programme initiated there. FIMG stands for the "formation initiale des maître de Guinée", a short-term teacher training programme introduced as a World Bank funded pilot project in 1998 to quickly prepare a high number of young adults to enter the teaching profession as contract teachers outside the civil service and with considerably lower salaries. As the programme combines the issue of contract teachers with the issue of reduced, rather than increased time for teacher training, many local observers predicted its detrimental effects on educational quality. It was questioned whether the obvious reductions in cost (as compared to the employment of other teachers with a civil servant status and the classical training) and the corresponding possibility to engage more teachers and to enhance enrolment would justify this risk in terms of quality.

PASEC data now show that FIMG teachers do not generally do worse than their colleagues. At 5th grade level, they even do significantly better (CONFEMEN 2003b, p 24). There also seems to be some improvement from the cohort of teachers trained in the first year, to those of the second year, where some features of the programme were adjusted and the intended tutoring at school level worked out more smoothly than before (CONFEMEN 2002a).

It should be noted that FIMG teachers generally hold at least the Bac and that they were often recruited among unemployed university graduates. In addition, they had to undergo a specific exam before being admitted into the programme (CONFEMEN 2002b, p. 16). Therefore, even though the professional training they receive is limited to a maximum of nine months before they start teaching, and another nine months of follow-up through local tutoring while they already practise their job, at least the knowledge of the subject matter seems to be ensured. Possibly, the dominance of this part of relevant competencies can explain why FIMG teachers tend to perform better at higher than at lower grades. However, since the training programme as such was reformed, too, improved quality may also have made up for reduced duration. Finally, the employment as contract teachers rather than on stable civil servants' positions may have also lead to increased performance incentives. Unfortunately, it is impossible to disentangle these different effects.

What also remains to be examined is how the programme will evolve in the long-run. In particular with respect to the contract teacher position, long-term and short-term effects might not lead into the same direction. While employment on a contract basis may raise performance in the short run as teachers need to make sure that their contracts will be renewed, once they find another more stable employment opportunity, they may be fast to

quit their current position. This refers us back to the somewhat puzzling conflict between job satisfaction on the one hand, and teaching performance on the other hand. Whether this conflict does arise in the case of the FIMG programme in Guinea and whether it leads to a significant drop out of the newly trained teachers thereby reducing the overall efficiency of the programme, cannot yet be analysed on the basis of the data currently available.

Finally, it should be noted that teacher competencies are not only a question of formal education and training. In particular, several PASEC studies have pointed out the positive link between the teachers' knowledge of the local language and student performance (see e.g. Michaelowa 2001a, p. 1707). Knowledge of the local language may simply be an indicator of the teachers' integration into the local community, but it may also be relevant as a factor facilitating explanations to students (especially at early grades) or as a factor facilitating the necessary exchange with parents. For Côte d'Ivoire, Amelewonou and Nkengne Nkegne (2003, p. 56) report a similar effect even for principals.

For educational policy, this implies that care should be taken when affecting teachers (and principals) to different locations. A deliberate policy *not* to send them to their home regions – as practised for a long time in Côte d'Ivoire – appears to be counter-productive. Affecting new teachers to regions where their integration and communication will be easy, is a simple policy measure that can be implemented at almost no cost.

Overall, it can be concluded that with respect to both teacher competencies and motivation, PASEC data allow us to challenge some perceived knowledge and lead us to be more cautious about simply equating teacher job satisfaction and education quality, or enhanced competencies and increased duration of teacher training.

Let us now turn to another area of educational policy where PASEC equally leads to rather unexpected results. The question is how to deal with high student numbers and how to best organise classes within schools. As teacher salaries are the most important cost factor for the education system, the overall cost depends as much on how many students are admitted into a single class, as on how much is invested into the individual teacher. While the latter was discussed above, the former is at focus in the following section.

3. Class size and class management

At the international level, there has been a long and ongoing debate about the relevance of class size. While authors such as Hanushek (1998) summarise the available evidence as little conclusive, and warn against putting too much emphasis on the issue given the high cost involved, others draw the opposite conclusion and claim that important gains in educational quality will be possible by reducing class size, in particular at early grade levels (see e.g. Biddle and Berliner 2002).

Whatever the results in these studies predominantly considering industrialised countries, one might expect a clearly negative effect of student numbers in Africa where average class size in primary schools is about twice or trice as high as in Europe or the United States. Surprisingly, even in the PASEC countries, evidence is far from conclusive. Table 2 shows that among 35 regressions that have been run for different countries and grade levels, and using different methodological approaches, only 9 show the expected significant negative impact of class size in a linear specification, and 6 show a significant positive sign. While one might agree that, at least below a certain limit, an increase in class size will not necessarily reduce student achievement (Hanushek, 1998, pp. 20ff.; Mingat and Suchaut 2001) an overall

positive coefficient is difficult to explain. In a model for 5th grade students in Burkina Faso, Cameroon, Côte d'Ivoire, Madagascar and Senegal, Michaelowa (2001a and b) therefore uses an alternative quadratic specification which provides a more plausible picture of the impact of class size. In this specification, coefficient estimates indicate that, beyond a threshold of about 60 pupils, additional students have an (increasingly) negative effect on learning. Nevertheless, it is worth noting that within realistic class sizes, even in Africa, the effect remains rather modest. In a class of 80 pupils, ten additional students would lead to a reduction in achievement by only 1.25 percentage points. In the most extreme case, at the sample's maximum class size of 139 students, a further increase by ten students would lead to a reduction in achievement by 4.5 percentage points, i.e. by 10% of average achievement. This relationship between class size and education quality, expressed as the share of correctly answered questions in the PASEC tests for math and French combined, is illustrated in Figure 2.

Figure 2: The impact of class size on education quality

Source: Michaelowa (2001b, p. 89).

Overall, the effect of class size on education quality appears to be rather modest. Analysing PASEC data on teaching strategies suggests one possible explanation: In seems as if in most countries considered, teachers tend to practise "frontal" teaching and do not change to more participatory pedagogical approaches even when class size is reduced (Michaelowa 2001b, pp. 90f.). This refers us back to the question of teacher training. If class size is reduced without a simultaneous training on how to adjust the teaching style, no sizeable effect on educational quality should be expected.

It remains that class size was shown earlier to be an important determinant of teacher job satisfaction. Thus there might be some additional indirect effect not considered in the above analysis.

Along with class size, Table 2 also allows us to consider the effect of one relatively frequent measure of how to deal with high student numbers: the management by double shifts. "Double shifts" indicates that two or three classes work in the same classroom, and generally with the same teacher, during different parts of the day. This is a tool to manage high numbers

of students within a given framework of infrastructure and teaching staff, without increasing class size.

The impact of double shift classes turns out to be significantly negative in 18 out of 37 different PASEC regressions considering this variable. Despite two cases of significant coefficients with the opposite sign, PASEC thus provides an overwhelming evidence that double shift classes imply considerable disadvantages for the students concerned.

Table 2: The effect of class management on student achievement, a synthesis of PASEC regression results

Number of regressions with coefficient being:	Class size	Double shift classes	Multigrade classes
Positively significant	6	2	7
Negatively significant	9	18	5
Negatively significant above a certain threshold	3	not applicable	not applicable
Insignificant	17	17	11
Total number of regressions considering this factor	35	37	23

Annotation: Significance refers to a level of α=10%; significance above a certain threshold refers to the significance of a quadratic specification.

Source: Table A1, Annex.

CONFEMEN (1999b, p. 42) and Mingat and Suchaut (2001) explain this effect by the reduced time devoted to each individual class in terms of teaching and correction of written assignments. It is often observed that even in countries where formal legislation implies that instructional time should be identical, in practice, frictions between the two shifts lead to reduced time the students spend in class. There may also be problems of class hours difficult to reconcile with the students' life rhythm, problems of heat in the afternoon or other similar constraints to effective learning (CONFEMEN 2002b, p. 50). Moreover, teaching two consecutive shifts is exhausting for the teacher, and PASEC data also suggest that teacher absenteeism is higher under this particular form of class management (Michaelowa 2002, p. 11). Interestingly, for the case of 5th grade students in Madagascar, Waller (2003) suggests that the negative effect of double shift classes may be less predominant when the teacher is female.

Given the quadratic relationship between class size and student performance on the one hand (as illustrated in Figure 2), and the negative linear relationship between double shift classes and student performance on the other hand, it is possible to calculate the number of students above which double shift management becomes an effective policy measure despite all the disadvantages discussed above. Using the coefficient estimates from Michaelowa (2001a) it turns out that the negative effect of double shift classes is so high that this point is reached only at about 100 students. This would imply that below a class size of about 100 students, double shift classes are generally inefficient.

It should be noted, in addition, that the critical class size was calculated here assuming the feasibility of double shifts without additional cost. In reality, however, double shift management often significantly increases cost since teachers have to be paid overtime rates for additional work hours. This further increases the minimum number of pupils for double shift classes to be an efficient policy option. The average class size in the PASEC sample does not suggest much scope for this management tool. Nevertheless, as there are considerable

cross-country differences in the concrete implementation of the double shift system, caution is required when generalising this result to all countries in the region.

Considerable differences between countries also exist with respect to the implementation of multigrade teaching, the last management tool presented in Table 2. Rather than for high student numbers, this strategy is used when student numbers are too small to create a separate class for each grade level. This implies that students of two or more grade levels are taught (simultaneously) within one class. Interestingly, this strategy does not generally have a negative effect on students' performance. Although less time can be specifically devoted to students of each grade, teaching can be adjusted in a way to let students benefit across different grades. Examples from other countries during the 1990s even show that multigrade teaching can be surprisingly successful (UNICEF 1999, p. 34; Jarousse and Mingat 1993). Again, it appears relevant to provide teachers with guidance on how to adjust their pedagogical approach to this particular context.

We can conclude that despite the high average class size in PASEC countries, the negative impact of this variable is not as strong and not as consistent as one might expect. As the negative impact of double shift classes is typically much higher, dividing classes into two shifts is generally efficient only when class size is extremely high (around 100 students). However, cross-country differences in the implementation of this tool of class management need to be taken into account. The same is true for specific national characteristics of multigrade teaching which, as opposed to double shifts, does not generally show a negative, but sometimes even a significantly positive effect on education quality.

Having dealt with teachers and the organisation of classes, it now remains to discuss some more concrete input factors into the learning process, necessary both for teachers and for students: physical infrastructure and educational material.

4. Physical infrastructure and instructional material

PASEC does include considerable information on both physical infrastructure and instructional material. Information on physical infrastructure includes the construction material of the school building, the availability of electricity, and the availability of different facilities such as bathrooms, a sanitary room, a fresh water point, office rooms and housing, a court yard etc. Moreover, there is information on the size of the classroom as well as the available furniture. Information on instructional material includes the availability of textbooks, copy-books, slates, pens or pencils, teacher manuals, a blackboard, chalk, instruments for geometry and wall maps.

However, only few of these variables appear in the regression models reviewed here. It appears that the indicators constructed on the basis of these variables were mostly insignificant and therefore left out in the final models. The indicator of basic equipment used in Michaelowa (2000 and 2001a) was significant only in one regression specification out of seven (see Table 3). A considerably higher number of studies includes the effect of electricity, but even here the evidence is far from conclusive. An unambiguously positive effect can be shown for teacher manuals, but the effect is considered only in five studies and does not always turn out to be significant.

Table 3: The effect of educational equipment on student achievement, a synthesis of PASEC regression results

	Textbooks	Other equipment

Number of regressions with coefficient being:	French	Math	French & Math	Teacher manuals	Electricity	Basic equipment[1]
Positively significant	16	5	20	2	4	1
Negatively significant	0	0	0	0	2	0
Insignificant	15	16	5	3	10	6
Total number of regressions considering this factor	30[2]	20[2]	25	5	16	7

[1] "Basic equipment" refers to the joint availability of a teacher's desk, a usable blackboard, seats and desks for all students, white chalk, pencils and copy books or slates for at least 75% of the students.
[2] The sum of coefficients is higher than the total number of regressions because one regression used two different variables implying two different coefficient estimates.

Annotation: Significance refers to a level of α=10%.

Source: Table A1, Annex.

Table 3 shows that only with respect to textbooks, the link to student learning appears to be strong and consistently positive. When books for both subjects, math and French, are considered separately in the same regressions, the effect comes out less clearly since both variables are highly correlated. Moreover, in this case, the impact of the French textbook generally dominates. This is little surprising because being able to read French is relevant for both subject matters.

It should be noted that different variables were used to measure the availability of textbooks. While in some studies, the possession of a textbook is identified at the level of each individual student, other studies use the percentage of students with textbooks within the class as the relevant variable. The latter specification reflects the idea of peer effects: Even if a student does not personally possess a textbook, he or she might benefit from the one of his or her neighbour. Based on this variable, Michaelowa (2001a, p. 1707) shows that, other things being equal, students in a class where each child has a textbook in both French and mathematics score 6.6 to 8 percentage points higher than students in a class with no books. A difference of 8 percentage points corresponds to almost 18% of mean scores and is therefore highly relevant.

However, some caution is required when interpreting this result. As the availability of textbooks is correlated with the children's socio-economic background, coefficients may be overestimated whenever this background is not correctly controlled for (Naumann, Trapp and Wolf 2002, p. 4). A similar reduction of the impact is noted by Waller (2003). Nevertheless, the coefficient of the French textbook generally remains sizeable and significant even in models where much care was taken to eliminate the bias of socio-economic background. Enhancing the availability of textbooks should therefore remain a priority of educational policy.

It should be noted that the literature suggests that even higher gains might be possible, if French were replaced by the children's local language during the initial years of primary schooling, and replaced only gradually thereafter. Correspondingly, textbooks in these local languages may be even more relevant than textbooks in French, in particular for the early grades (Naumann and Wolf 2001). Moreover, as already noted by Lockheed and Verspoor (1991, p. 52), the simple provision of textbooks does not guarantee their use. Here also, adequate training for the teachers supposed to use these books appears to be necessary.

Overall, we can conclude that among all variables of instructional material and physical infrastructure, textbooks in the language of instruction most clearly influence education quality. Despite growing awareness of the importance of this learning tool, it still seems that

many developing countries first try to ensure the quality of the school building and the appropriateness of other physical infrastructure. For instance, PASEC data show that the percentage of concrete schools in Burkina Faso, Cameroon, Côte d'Ivoire and Madagascar (Bernard 1999b, p. 20) is much higher than the percentage of textbooks available to fifth grade students (Michaelowa 2001a, p. 1710). In a perspective of setting priorities in order to make the best use of given financial means, the right balance between physical infrastructure and the availability of textbooks should be reconsidered.

Having discussed the most relevant variables typically analysed in studies of student achievement for countries all over the world, let us now turn to one of the more specific problems of education in francophone (and lusophone) sub-Saharan Africa: the extremely high repetition rates.

5. Repetition rates and their impact on student learning

Grade repetition is not typically considered as an input into student learning. Nevertheless, discussions with teachers in PASEC countries reveal that, from their point of view, repetition is an essential tool to ensure that less able students get a second chance to acquire the basic knowledge necessary to follow and benefit from the instruction at higher levels. Among the teachers asked in Senegal, almost 80% esteemed repetition to be an efficient measure, and 28% even felt that it was extremely efficient. Only 2% stated that repetition was fully inefficient (CONFEMEN 2003c, p. 76).

Average repetition rates, as currently practised, are presented in Table 4. It appears that in francophone (and lusophone) Africa, repetition rates are about twice as high as in anglophone Africa, although even there, they are already about four times as high as in the average OECD country.

Table 4: Average repetition rates in African primary education, 2000

Country group	Repetition rate
Africa	17.5 %
Anglophone Africa	10.3 %
Francophone Africa	19.8 %
Lusophone Africa	23.4 %
OECD (for comparison)	2.2 %

Source: UIS (2002), MINEDAF (2002, p. 50).

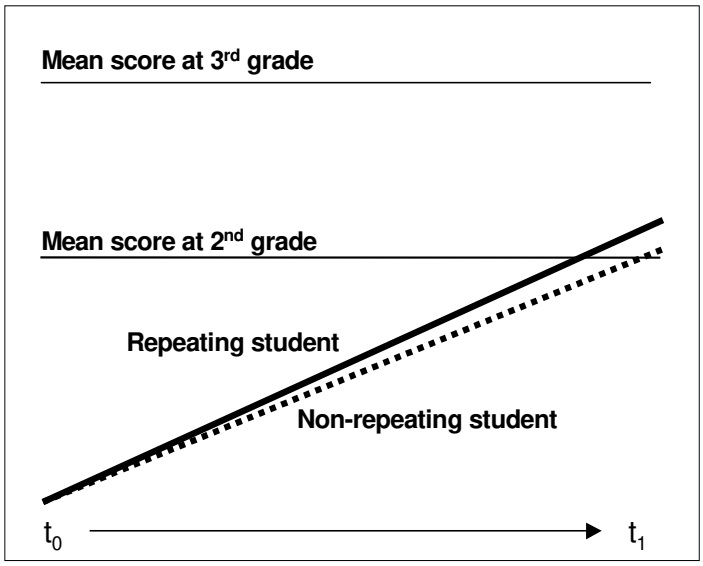
Repetition rates of about 20% as currently observed for francophone Africa impose considerable costs on the education system. As children do not pass through the different grades immediately, the education system needs to cope with even more pupils – implying even higher requirements of teachers, classrooms, instructional material etc. If countries are not able to finance these additional requirements, high repetition rates often lead to reduced or delayed enrolment. This can be conceived as the social cost of repetition.

On the basis of PASEC data, it can now be analysed whether the learning benefits of repetition are really so impressive that they justify the considerable financial investment required to finance this policy. Based on a 5-year panel of primary students in Senegal and Côte d'Ivoire, CONFEMEN (2003c) initially investigates, whether repetition is actually well targeted at those students with the lowest ability level. On the basis of the PASEC test in French and math, pupils were allocated into three equal groups of low, medium and high ability. It turns out that among the 2nd grade students in both Senegal and Côte d'Ivoire, 71% of those requested to repeat their grade belong to the third of low ability students. Even

though this is the large majority, the proportion of students who does not belong to this group and is yet requested to repeat, remains considerable. 21% belong to the third of medium-, and 7% even to the third of high-ability students. Moreover, at higher grade levels, the problem of wrong targeting becomes even stronger.

Let us assume a case where a student requested to repeat was well targeted, i.e. he really belongs to the worst performing students and may therefore be at risk not to be able to follow classes at a higher grade. To what extent he or she effectively benefits from repetition can be deduced from a comparison with another student at the same initial ability level, who is not requested to repeat. In order to make these two students fully comparable, other influences such as the socio-economic background, school and classroom characteristics are corrected for. The outcome of this exercise for 2nd and 3rd grade students in Senegal is illustrated in Figure 3.

Figure 3: The learning benefits of grade repetition



Source: CONFEMEN (2002a, p. 8).

From t_0, the year in which the decision is taken about repetition, to t_1, the year in which one of the two students has completed the 3rd, the other one repeated the 2nd grade, both students show a very similar learning progress (bold line for the repeating, dashed line for the non-repeating student). From a position far below their class average, they will both reach a level of ability which places them close to the average of 2nd grade students.

Unfortunately, this progress will be observed much more in the context of the student who repeats. Only this student will indeed be compared to the 2nd grade average and his or her new position tends to be taken as a sign of successful catching up. The non-repeating student, however, will be compared to the average of 3rd grade students, and it will only be noticed that he or she is still lagging considerably behind.

CONFEMEN (2003c) suggests that it is this different perception of the relative position which might induce teachers to wrongly attribute a strongly beneficial effect to grade repetition. In reality, the effect is only small and sometimes insignificant, even if well targeted on low-ability students. If targeting is wrong, repetition can be shown to even hinder the student's further learning progress (CONFEMEN 1999a, p. 120). As presented above, wrong targeting is currently rather frequent.

All in all, it can be concluded that as opposed to the perception of many teachers in francophone Africa, repetition cannot substantially increase student performance. Since targeting low-ability students is generally not very precise, there is a considerable risk that repetition even hinders learning progress. Moreover, considering that repetition is closely correlated with early drop-out, even the sustainability of basic knowledge already acquired may be put at risk. It should therefore be a high priority of education policy to rise the awareness of this problem among teachers and all other persons involved in decisions about repetition. Moreover, a legally binding upper threshold needs to be put on repetition rates and enforced in all schools in the region.

6. Conclusions

This paper has provided a brief overview over some of the most important results from studies based on the PASEC data set. This synthesis reveals a few important policy conclusions.

With respect to both teacher competencies and motivation, PASEC data allow us to challenge some perceived knowledge and lead us to be more cautious about simply equating teacher job satisfaction and education quality, or enhanced competencies and increased duration of teacher training. As already observed by Lockheed and Verspoor (1991), enhancing teacher competencies requires reforms in the content and quality of teacher training, rather than simple reforms of its duration. If well designed, approaches such as the employment of contract teachers based on short-term training with an emphasis on supervised practice in class (e.g. the FIMG approach), appear to be an efficient means of meeting the combined challenge to enhance enrolment without compromising on education quality.

PASEC data also lead us to conclude that despite the high average class size in francophone African countries, the negative impact of student numbers is not as strong and not as consistent as one might expect. As the negative impact of double shift classes is typically much higher, dividing classes into two shifts is generally efficient only when class size is extremely high (around 100 students). However, cross-country differences in the implementation of this tool of class management need to be taken into account. The same is true for specific national characteristics of multigrade teaching which, as opposed to double shifts, does not generally show a negative, but sometimes even a significantly positive effect on education quality.

Among instructional materials and physical infrastructure, textbooks in the basic language of instruction appear to have the most important positive influence on education quality. Despite growing awareness of the importance of this learning tool, it still seems that many developing countries first try to ensure the quality of buildings and the appropriateness of other physical infrastructure. These priorities might need to be reconsidered.

Finally, PASEC provides strong and unambiguous evidence against the efficiency of grade repetition. Current repetition rates of about 20% in primary education are far too high. They create considerable cost in terms of both lower initial enrolment and higher drop-out, without really improving student achievement. As a wrong perception of the effectiveness of repetition appears to prevail among teachers, awareness rising should be a high priority of education policy. Moreover, a legally binding upper threshold needs to be put on repetition rates and enforced in all schools in the region.

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Annex

Table A1: Signs of coefficients of selected variables in PASEC regressions

Study	Country	Grade	Subject	Textbooks			Electricity	Basic equip-ment	Teacher manual	Class size	Double-shift	Multi-grade
				French	Math	Math+ French						
CONFEMEN (1999a)												
	BF, CM, CI, MD, SN	2	math+French	+		+	n.s.			n.s.	n.s.	n.s.
	BF	2	math+French	+		+	+			-	n.s.	-
	CM	2	math+French	n.s.		+	n.s.			n.s.	-	n.s.
	CI	2	math+French	n.s.		n.s.	-			-	n.s.	-
	MD	2	math+French	n.s.	n.s.		n.s.			n.s.	+	+
	SN	2	math+French	+		+	n.s.			+	-	n.s.
	BF, CM, CI, MD, SN	5	math+French	n.s.		+	n.s.			-	-	+
	BF	5	math+French	n.s.		+	n.s.			n.s.	n.s.	-
	CM	5	math+French	n.s.		n.s.	+			-	+	-
	CI	5	math+French	n.s.		n.s.	-			n.s.	-	n.s.
	MD	5	math+French	n.s.	+		+			-	-	+
	SN	5	math+French	+		+	+			-	-	+
Michaelowa (2000)												
	BF, CM, CI, MD, SN	5	math+French	n.s. / +[1]	n.s. / n.s.[1]			n.s.	n.s.	n.s.	-	n.s.
	BF, CM, CI, MD, SN	5	math+French			+[1]		n.s.	+	+	-	n.s.
	BF, CM, CI, MD, SN	5	math+French			+[1]		n.s.	+	+	-	n.s.
	BF, CM, CI, MD, SN	5	math+French			+[1]		n.s.	n.s.	+	n.s.	n.s.
	BF, CM, CI, MD, SN	5	math+French			+[1]		n.s.	n.s.	+	n.s.	n.s.
Michaelowa (2001a)[1]												
	BF, CM, CI, MD, SN	5	math+French			+		+		+	-	+
	BF, CM, CI, MD, SN	5	math+French			+		n.s.		-[4]	n.s.	+
Naumann and Wolf (2001)[2]												
	SN	2	French	+	n.s.							
	SN	2	math	+	n.s.							
	SN	2	French	+	n.s.							
	SN	2	math	+	n.s.							
	SN	2	French	+	n.s.							
	SN	2	math	+	n.s.							
	SN	2	French	+	n.s.							
	SN	2	math	+	n.s.							
Bernard (1999a)												
	BF, CM, CI, MD, SN	2	math+French	+	+		n.s.			n.s.	-	n.s.
	BF, CM, CI, MD, SN	5	math+French	n.s.	+		n.s.			-	-	+
	BF, CM, CI, SN	2	math+French	+	+		n.s.			n.s.	-	-
	BF, CM, CI, SN	5	math+French	n.s.	n.s.		n.s.			-	-	n.s.
Michaelowa (2001b)												
	BF, CM, CI, MD,	5	math+Franc							-[4]	n.s.	

SN		h						
BF, CM, CI, MD, SN	5	math+French					- [4]	-
BF	5	math+French					n.s.	n.s.
CM	5	math+French					n.s.	n.s.
CI	5	math+French					n.s.	n.s.
MD	5	math+French					n.s.	n.s.
SN	5	math+French					n.s.	n.s.
Waller (2003)[3]								
MD	5	French			+			
MD	5	French			+			
MD	5	math			+			-
MD	5	math			+ [5]			- [6]
CONFEMEN (2003b)								
GI	2	math+French	+	n.s.			-	n.s.
GI	2	math+French	n.s.	n.s.			n.s.	n.s.
GI	5	math+French	n.s.	n.s.			n.s.	n.s.
GI	5	math+French	n.s.	n.s.			n.s.	n.s.
GI	5	math+French	n.s.	+			n.s.	-

Annotation: BF=Burkina Faso, CM=Cameroon, CI= Côte d'Ivoire, MD=Madagascar, SN=Senegal, GI=Guinea; n.s.= non significant at the 10% level.

[1] Availability of textbooks considered at the class level.

[2] Regressions based on the pre-test were not considered.

[3] The textbook variable also includes books at home.

[4] Quadratic specification implying a negatively significant relationship above a certain threshold.

[5] In a gender differentiated model significant only for female teachers.

[6] In a gender differentiated model significant only for male teachers.